AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph on page 10, beginning at line 2, with the following amended paragraph:

It is an objective of the present invention to provide a method and computer program product for improving a lithographic process using a fast, accurate simulation of the lithographic process and the image formed thereof. It is an objective of the present invention to provide a method for obtaining solely analytical expressions for all of the TCC integrals for use in a simulation of a lithographic process. A further objective of the present invention is to provide an approximate analytical representation for the TCCs that is accurate to within a desired small error, for example, within the precision of a given computer, which is typically on the order of about 10^{-6} for typical single precision calculations in current machines. It is yet a further objective of the present invention to provide a method for computing aerial images very rapidly compared to conventional numerical integration techniques, and to within a desired accuracy, for example very close to machine precision. That is, a primary objective of the present invention is to eliminate the tradeoff between speed and accuracy in the simulation of aerial images, achieving both simultaneously, for use in improving a lithographic process.

Please add the following two new paragraphs on page 10, after line 24 and before the paragraph beginning at line 25:

A first aspect of the present invention is directed to method of improving a lithographic process, the method comprising: providing a mask design for a mask capable of use in a lithographic process, said mask having a mask function in the spatial frequency domain, wherein said lithographic process includes the use of a projection system having a defocus amount z along an optical axis, the projection system including pupil optics; providing a source function having a center spatial frequency coordinate; providing a first paraxial pupil function of the pupil optics at a first offset relative to said center spatial frequency coordinate and providing a second paraxial pupil function of the pupil optics at a second offset relative to said center spatial frequency coordinate;

forming an integrand comprising a product of functions including said source function, said first paraxial pupil function, and said second paraxial pupil function; defining an integration region spanning the intersection of said source function with said first and second paraxial pupil functions, said integration region having a boundary comprising a finite number of arcs; integrating said integrand for each of said finite number of arcs to obtain a finite number of contour integrals each corresponding to one of said finite number of arcs, wherein each of said finite number of contour integrals comprises an analytical solution; determining a transmission cross-coefficient (TCC) comprising a sum of said finite number of contour integrals; simulating an image of said mask in accordance with said lithographic process using said TCC; and using said image to improve said lithographic process.

A second aspect of the present invention is directed to a computer program product comprising computer readable storage medium having stored therein computer readable instructions executable by the computer for causing a computer to perform method steps for improving a lithographic process, the method steps comprising: providing a mask design for a mask capable of use in a lithographic process, said mask having a mask function in the spatial frequency domain, wherein said lithographic process includes the use of a projection system having a defocus amount z along an optical axis, the projection system including pupil optics; providing a source function having a center spatial frequency coordinate; providing a first paraxial pupil function of the pupil optics at a first offset relative to said center spatial frequency coordinate and providing a second paraxial pupil function of the pupil optics at a second offset relative to said center spatial frequency coordinate; providing an integrand comprising a product of functions including said source function, said first paraxial pupil function, and said second paraxial pupil function; defining an integration region spanning the intersection of said source function with said first and second paraxial pupil functions, said integration region having a boundary comprising a finite number of arcs; integrating said integrand for each of said finite number of arcs to obtain a finite number of contour integrals each corresponding to one of said finite number of arcs, wherein each of said finite number of contour integrals comprises an analytical solution; determining a transmission cross-coefficient (TCC) comprising a sum of said finite number of contour integrals; simulating

an image of said mask in accordance with said lithographic process using said TCC; and using said image to improve said lithographic process.